Section 3 - Power Distribution

This section explains how the OEC Workstation develops its AC and DC operating potentials from AC line current and how it distributes the DC potential internally. This section covers the following topics:

References

Refer to the following Workstation block diagrams and schematics as you read this section:

- Workstation Interconnect Diagram 00-878981
- Surge Suppressor PCB Schematic 00-880538
- Power Control PCB Schematic 00-880315
- DC Distribution PCB Schematic - 00-879117

AC Electrical Requirements

AC line current for both the Workstation enters the power cord at the rear of the Workstation. The Workstation can be strapped for 91-128 VAC or 182-256 VAC single-phase operation, and is delivered with the correct power cord assembly for the customer's local AC service. For ease of communication, this manual refers to the two line voltage ranges as 115 VAC and 230 VAC.

Outlet Capacity

The Workstation must be connected to an outlet capable of providing at least 15 Amps at 115 VAC, or 8 Amps at 230 VAC.

Line Regulation

The AC outlet must be able to supply its nominal line voltage reliably at maximum current capacity, even during peak demand periods. Line voltage must not drop more than 15%.

Outlet Safety

WARNING: *Check the electrical outlet for open ground, open neutral, phase-to-neutral reversal, and improper line voltage before connecting the system to the outlet. Connecting the system to an improperly wired electrical outlet can result in death, personal injury, equipment damage, or improper equipment operation.*

Continuous AC

Note: *The Workstation AC power plug should be connected to a dedicated AC outlet. DO NOT connect the system to an AC outlet that is controlled by a wall switch, or one that is on the same breaker with appliances, electric motors, or other large or inductive loads.*

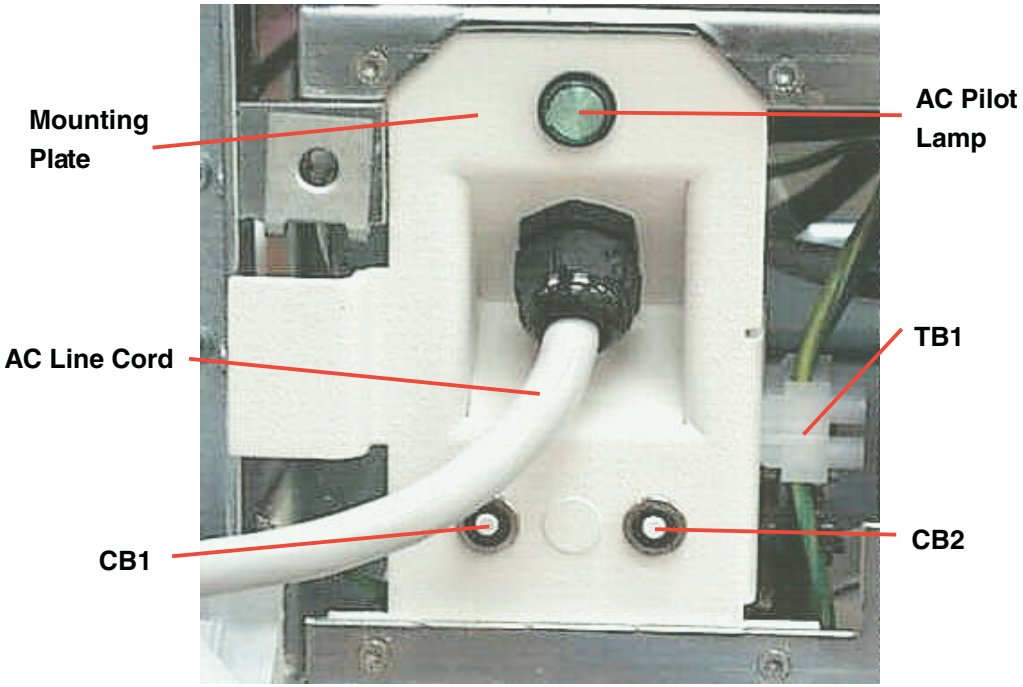
Note: *If a C-Arm is attached, keep the system plugged into the AC outlet at all times, even when it is not being used. C-Arms use lead acid storage batteries that must be constantly trickle charged to maintain their proper operating potential.*

AC Power Cord Assembly

Page 3 of the **Workstation Interconnect Diagram 00-878981** provides wiring diagrams for the Workstation power cord assemblies. Note that there is a separate power cord assembly for 115 VAC and 230 VAC operation. Each power cord assembly includes the power plug, power cord, a terminal block, one or two AC line circuit breakers, chassis ground wire and terminal, and AC pilot lamp assembly. Each component in the AC power cord assembly is field replaceable.

Location

Four torx screws secure the AC Power Cord Assembly mounting plate to the bottom left corner of the Workstation rear panel.



120 VAC Power Cord Assembly Mounting Plate

Removal and Replacement

Follow these steps to replace the AC Power Cord Assembly:

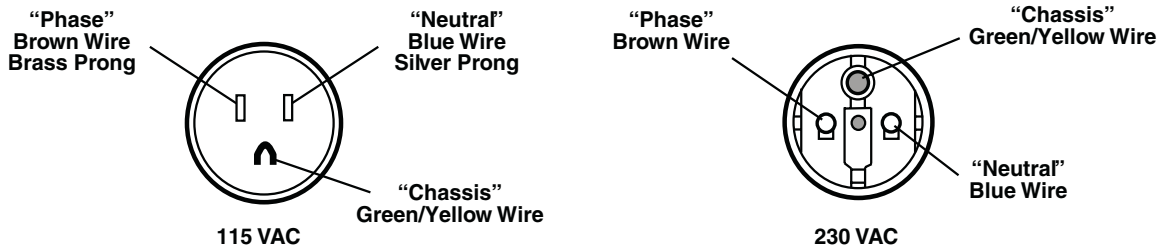
1. Inspect replacement AC Power Cord Assembly for obvious damage or missing components.
2. Disconnect AC plug from facility's AC outlet.
3. Remove Workstation rear cover.
4. Disconnect green/yellow chassis ground wire from TB1. Leave other end of wire connected to Surge Suppressor PCB.
5. Disconnect A38J1 from Surge Suppressor PCB.
6. Remove four torx screws that secure AC Power Cord Assembly mounting plate to Workstation rear chassis. Retain screws.
7. Lift AC Power Cord Assembly from Workstation.
8. Connect A38J1 on replacement AC Power Cord Assembly to P1 on Surge Suppressor assembly. Ensure connector locks in place.
9. Connect green/yellow chassis ground wire disconnected in step 3 to TB1-6.
10. Secure Power Cord Assembly mounting plate to Workstation rear chassis using torx screws removed in step 5.
11. Connect Workstation's AC power plug to facility's AC outlet.
12. Power up Workstation and check for proper operation.
13. Install Workstation rear cover.

AC Power Plug

The system has distinctly different power plugs for 115 VAC and 230 VAC operation. While each plug has phase, neutral, and chassis ground conductors, their physical configurations are not alike.

Types

The following illustration shows the two basic kinds of Workstation AC power plugs.



Workstation AC Power Plugs

WARNING: *Never operate the system without the AC plug's grounding prong in place. Failure to heed this warning may result in death, personal injury, equipment damage, or improper equipment operation.*

Removal and Replacement

Follow these instructions to replace the Workstation's AC line plug:

115 VAC Plug

1. Disconnect plug from AC outlet.
2. Loosen cord clamp setscrew.
3. Loosen two screws that secure plug collar around cord.
4. Separate plug collar from plug body. Pull plug body with attached cord through loosened collar far enough to expose three wire terminals on plug body.
5. Loosen three screws to disconnect cord wires from plug terminals.
6. Inspect cord wires for broken strands or cut insulation. If necessary, cut off damaged portion of cord and prepare wire ends by removing 1 inch (25 mm) of cord jacket and 1/4 inch (6 mm) of insulation from each cord conductor.
7. Inspect replacement plug for damaged or missing components.
8. Thread prepared AC line cord through collar on replacement plug.
9. Twist together strands on each line cord wire.
10. Insert green/yellow (ground) conductor into terminal for cylindrical ground prong. Push wire into terminal fully and secure setscrew.
11. Insert blue (neutral) wire into terminal for silver-colored flat prong. Push wire into terminal fully and secure setscrew.
12. Insert brown (line) wire into terminal for brass flat prong. Push wire into terminal fully and secure setscrew.
13. Press plug body into plug collar.
14. Secure two screws on plug collar.
15. Secure cord clamp on outer jacket of line cord. Ensure cord does not move under clamp.

230 VAC Plug

1. Disconnect plug from AC outlet.
2. Loosen setscrew that secures plug boot to plug body.
3. Separate plug boot from plug body. Pull plug body with attached cord through boot far enough to expose three wire terminals on plug body.
4. Loosen clamp that holds line cord to plug body.
5. Loosen three screws to disconnect cord wires from plug terminals.
6. Inspect cord wires for broken strands or cut insulation. If necessary, cut off damaged portion of cord and prepare wire ends by removing 1 inch (25 mm) of cord jacket and 1/4 inch (6 mm) of insulation from each cord conductor.
7. Inspect replacement plug for damaged or missing components.
8. Thread prepared AC line cord through boot from replacement plug and under loosened clamp on plug body.
9. Twist together strands on each line cord wire.
10. Insert green/yellow (ground) conductor into center terminal on plug. Push wire into terminal fully and secure setscrew.
11. Insert blue (neutral) wire into left-hand terminal. Push wire into terminal fully and secure setscrew.
12. Insert brown (line) wire into right-hand terminal. Push wire into terminal fully and secure setscrew.
13. Secure clamp over jacket on line cord. Ensure cord does not move under clamp.
14. Press plug body into plug boot.
15. Secure setscrew on plug boot.

AC Pilot Lamp

The green AC pilot lamp glows any time the system is connected to a normal, active AC power source. Unless it is physically damaged, the neon lamp normally lasts the life of the Workstation.

Location

The AC pilot lamp is located on the **Power Cord Assembly mounting plate** above the AC power cord strain relief.

Removal and Replacement

The AC Pilot Lamp is not available as a replacement part. If it fails, **replace the AC Power Cord assembly**.

AC Line Circuit Breakers

Reset-only circuit breakers protect Workstation AC inputs. 115 VAC Workstations have four breakers (CB1 through CB4) and 230 VAC Workstations have three circuit breakers (CB1, CB3, and CB4).

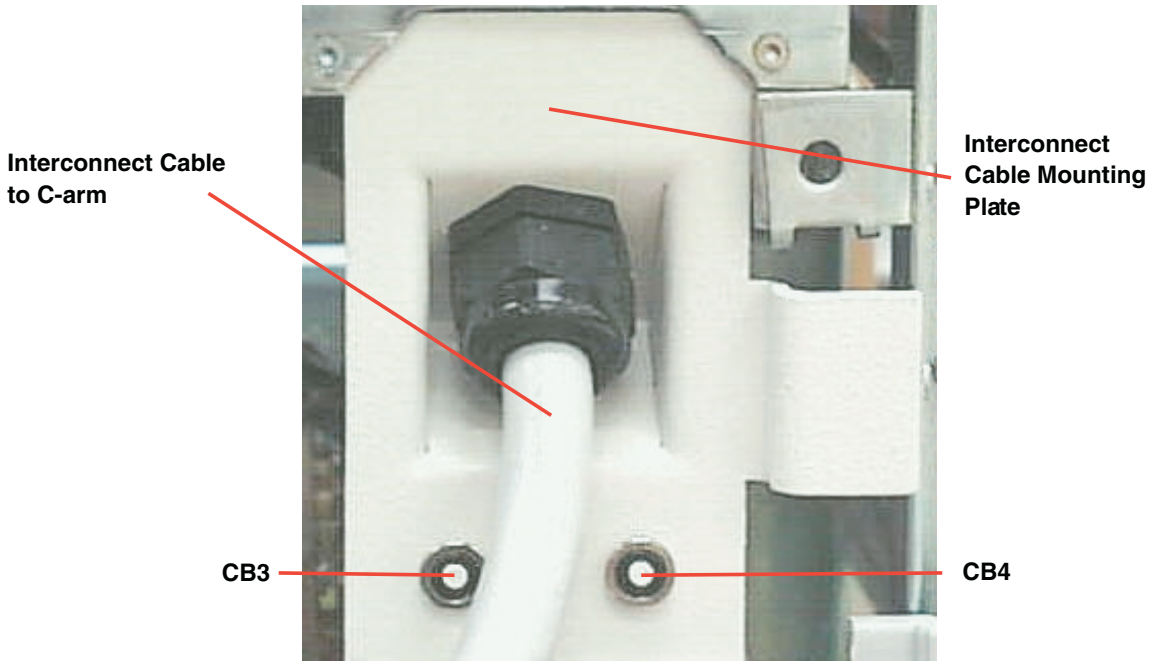
Location

CB1 mounts on the **AC Power Cord Assembly mounting plate** below the power cord strain relief. CB1 is a 20-Amp, reset only breaker in 115 VAC systems and a 10-Amp reset only breaker in 230 VAC systems.

CB2 is present in 115 VAC systems only, and mounts on the **AC Power Cord Assembly mounting plate** next to CB1. CB2 is a 10-Amp, reset only breaker that protects AC power to the two primary windings in the Isolation Transformer.

CB3, which mounts on the **Interconnect Cable mounting plate** below the interconnect cable strain relief, is a 10-Amp, reset only breaker that protects 115 VAC power.

CB4 mounts on the **Interconnect Cable mounting plate** below the interconnect cable strain relief. It is 5-Amp, reset only breaker that protects 230 VAC power to Workstation circuitry.



Interconnect Cable Mounting Plate

Troubleshooting

Replace a circuit breaker when it won't reset with the power off, or when it repeatedly trips with no obvious cause.

Removal and Replacement

WARNING: *AC line voltage is present on circuit breaker terminals. To avoid dangerous electrical shock, disconnect Workstation AC line plug from facility AC outlet before attempting to replace a circuit breaker.*

Follow these steps to replace CB1, CB2, CB3, or CB4:

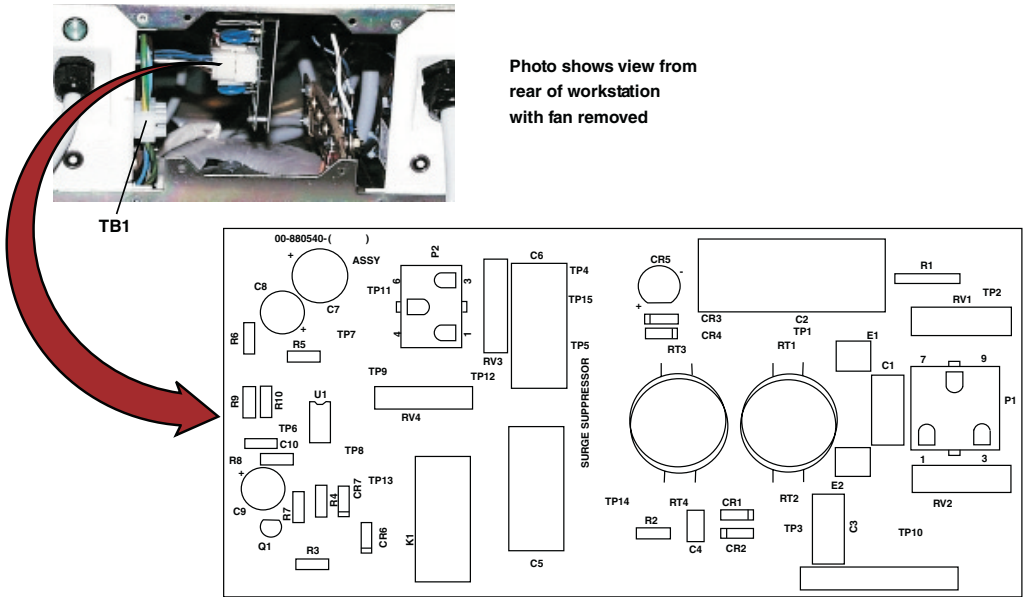
1. Disconnect AC power plug from facility's AC outlet.
2. Remove rear cover from Workstation.
3. Remove four torx screws that secure AC Power Cord mounting plate or Interconnect Cable mounting plate to Workstation chassis. Retain screws for reuse.
4. Disconnect and tag wires from circuit breaker to be replaced.
5. Carefully loosen and remove dress nut that secures circuit breaker to mounting plate. Remove circuit breaker from mounting plate.
6. Inspect replacement circuit breaker for obvious damage.
7. Connect wires disconnected in step #4 to replacement circuit breaker.
8. Mount replacement circuit breaker to mounting plate. Secure dress nut.
9. Use four torx screws removed in step #3 to secure mounting plate to Workstation.
10. Connect Workstation AC power plug to facility's AC outlet.
11. Test Workstation for proper operation.
12. Install Workstation rear cover.

Surge Suppressor PCB

The following discussion refers to the Surge Suppressor PCB shown next and to **Surge Suppressor PCB Schematic 00-880538**.

Location

The Surge Suppressor PCB mounts in the bottom cavity of the Workstation chassis above the Isolation Transformer as shown on the following page. It sits between the AC Power Cord Assembly mounting plate and the Interconnect Cable mounting plate directly in front of a cooling fan at the bottom rear of the Workstation chassis.



Surge Suppressor PCB

Circuit Description

The Surge Suppressor PCB protects the Isolation Transformer from gross overvoltage conditions, undervoltage conditions, surges, and spikes on the AC line.

Overvoltage Protection

Overvoltage protection circuitry consists of a range switch (Q1 and associated components), overvoltage lockout comparator (U1 and associated components), overvoltage lockout relay K1, and a charge pump +24 VDC power supply that operates these circuits.

Power Supply. A charge pump power supply generates the +24 Volts necessary to close relay K1 and transfer AC line current through the Surge Suppressor PCB to the Isolation Transformer. The +24 Volts also operates overvoltage lockout comparator U1. The power supply consists of R1, C2, bridge rectifier CR5, zener diode regulators CR3 and CR4, and electrolytic capacitor C7. The +24 Volts is present as long as the Workstation is plugged into an active AC outlet that supplies nominal AC line voltage.

***Note**: The +24 VDC from this supply references pin 3 of CR5, not chassis ground. Pin 3 of CR5 (and TP5) may be floating and should not be used for ground when measuring other potentials on the Surge Suppressor PCB.*

Overvoltage Lockout Comparator. The overvoltage lockout circuitry is most likely to see service if a Workstation wired for 115 VAC operation is accidentally connected to a 230 VAC source. U1 provides the overvoltage lockout. As long as U1-2 is sufficiently lower in potential than U1-3, pin U1-7 is low and K1 is energized. U1-3 stays at about 6 volts. U1-2 has a lower potential than U1-3 as long as the line voltage is normal. When the line voltage rises, however, the potential on U1-2 also rises, causing pin U1-7 to go high and K1 to de-energize.

Range Switch. Range switch Q1 turns on when the Workstation is powered by a 230 VAC source, keeping U1-2 at about the same potential it would have with the Workstation connected to a 115 VAC source.

Undervoltage Protection

The charge pump +24 Volt power supply's output drops when the line voltage sags. K1 drops out when line voltage drops to 70 VAC or below.

Spike Protection

RV1 is a 300-VAC metal oxide varistor (MOV) wired in series with gas discharge tube E1. The MOV and gas discharge tube together limit common mode voltage spikes between the neutral AC conductor and chassis ground to 800 Volts. RV2 and E2 provide similar common mode protection for spikes that occur between the line AC conductor and chassis ground. RV3 and RV4 limit line-to-neutral (normal mode) spikes to 400 volts. Capacitor C1 (.01uf) absorbs faster spikes before they reach RV3 and RV4. C5 and C6 (both .47uf) damp smaller pulses and spikes before RV3 and RV4 clip them.

Inrush Current Limiting

Thermistors RT1 through RT4 each have a cold resistance of about 2.5 ohms, which effectively limits inrush current at powerup. Thermistor resistance decreases to about .06 ohms as they reach operating temperature.

Test Points

WARNING: *Dangerous AC line voltage potentials are present on many Surge Suppressor PCB components and conductors. Probe all test points carefully. Replace the card with the AC power plug disconnected from the AC outlet.*

Normal operating potentials are as follows:

TP1 to **TP2** -- AC line voltage

TP3 to **TP10** -- 0 Volts

TP4 to **TP10** -- Pulses at AC line frequency

TP5 to **TP15** -- 24 VDC

TP6 to **TP5** -- less than +6 VDC

TP7 to **TP9** -- 6 VDC

TP8 to **TP9** -- .7 VDC

TP10 to **TP11** -- 0 Volts

TP11 to **TP12** -- 115 VAC

TP13 to **TP14** -- 115 VAC

TP15 to **TP5** -- +24 VDC

Circuit Breakers and Fuses

The Surge Suppressor PCB has no fuses or circuit breakers.

Troubleshooting

- One indication of an open thermistor in a 115 Volt system is an overheated isolation transformer and frequent tripping of CB2. Transformer overheating is caused by one primary winding being open and the other primary winding carrying the entire load.
- There is no easy way to test for an open MOV or nonconductive gas discharge tube. If you suspect a failure of one of these components or see evidence of component overheating or damage, replace the Surge Suppressor PCB.
- If CB1 trips immediately when you plug in the power cord, look for a shorted MOV or capacitor.
- If 24 VDC power supply fails, K1 does not close, making the entire system inoperative.
- If you find a faulty component on the Surge Suppressor PCB, replace the board.

Removal and Replacement

Follow these steps to replace the Surge Suppressor PCB:

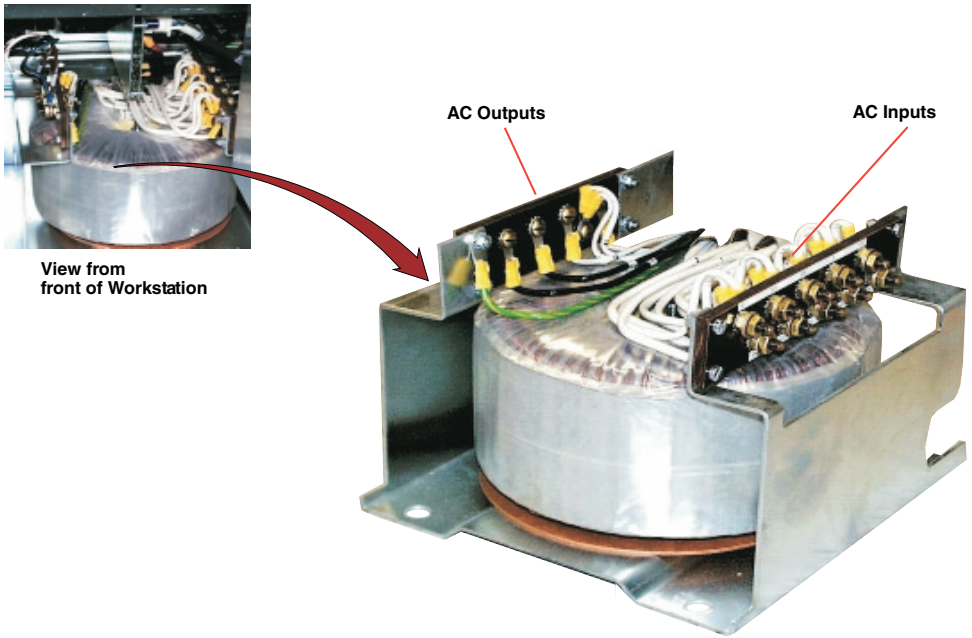
1. Disconnect AC power plug from facility's AC outlet.
2. Remove Workstation rear cover.
3. Remove four torx screws that attach Surge Suppressor PCB to chassis bracket. Save mounting hardware for reuse.
4. Disconnect connectors from P1 and P2 and tag both connectors.
5. Inspect replacement Surge Suppressor PCB for any obvious damage or missing components.
6. Reinstall tagged connectors to P1 and P2 on the new Surge Suppressor PCB.
7. Mount new PCB on chassis bracket and secure mounting hardware.
8. Connect AC power plug to facility's AC outlet.
9. Check system for proper operation.
10. Reinstall Workstation rear cover.

Isolation Transformer

The following paragraphs describe the AC power Isolation Transformer.

Location

The Isolation Transformer mounts on the bottom of the Workstation chassis below the Surge Suppressor PCB. The Isolation Transformer assembly includes the large, donut-shaped toroid, an input terminal strip, an output terminal strip, a mounting bracket, and mounting hardware.



Isolation Transformer

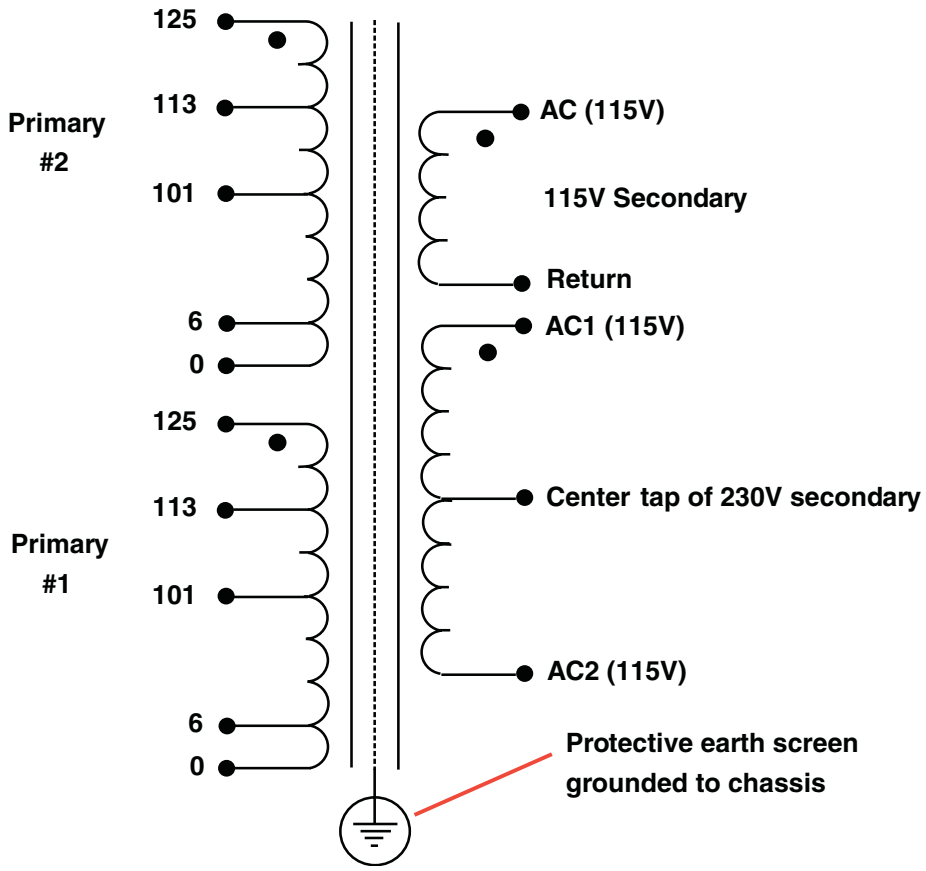
Circuit Description

The isolation transformer performs two functions. First, it provides DC isolation of the Workstation from the AC line. Next, it transforms the line voltage to the levels necessary to operate the Workstation. The transformer has two identical multi-tapped primary input windings that can be closely matched to the existing AC line voltage. The AC line cord assembly for 115 VAC applies power to the primary windings in parallel. The line cord assembly for 230 VAC applies power to the primary windings in series. The transformer has two secondary windings: a 115-Volt secondary winding which can power external equipment such as a C-Arm and a 230-Volt center-tapped secondary winding that powers the Workstation. A safety shield covers the entire transformer and connects to the Workstation's chassis ground via a green/yellow 18 AWG wire.

Test Points

Use the isolation transformer's input and output terminals shown on the following screen to make voltage and resistance checks when it is necessary to troubleshoot the transformer.

WARNING: *Dangerous AC line voltages are present on the isolation transformer's input and output terminals. Use great care when making voltage checks. When possible, troubleshoot the transformer using continuity and resistance checks with the AC power OFF.*



Isolation Transformer Schematic

***WARNING**: Dangerous AC line voltages are present on the isolation transformer's input and output terminals. Use great care when making voltage checks. When possible, troubleshoot the transformer using continuity and resistance checks with the AC power OFF.*

Circuit Breakers and Fuses

The isolation transformer has no internal circuit breakers or fuses.

Troubleshooting

***WARNING**: Make following checks with system's AC power plug disconnected from facility's AC outlet.*

The isolation transformer is very rugged and conservatively rated, so its failure during normal system operation is highly unlikely. However, you must replace the isolation transformer when it exhibits any of the following problems:

- Open primary or secondary winding
- Two or more windings shorted to each other or to the transformer core
- Winding shorted to shield or winding shorted to isolation transformer safety ground
- A winding shorted internally. Each primary winding should have a DC resistance of about .250 ohms. The 115-Volt secondary should have a DC resistance of about .28 ohms. The 230-Volt secondary's DC resistance should be about .83 ohms.
- Obvious mechanical damage
- Obvious damage from overheating

Removal and Replacement

***CAUTION**: The isolation transformer assembly is heavy. Get assistance when removing or installing it.*

1. Disconnect AC power plug from AC outlet.
2. Remove Workstation covers.
3. Without disturbing any wires that go to the transformer itself, disconnect all external wiring from input terminal strip and output terminal strip. Tag each wire as you disconnect it.
4. Remove four nuts and four washers that secure transformer bracket to Workstation chassis. Retain this hardware for reuse.
5. Carefully lift isolation transformer assembly from chassis and set it aside.
6. Inspect replacement isolation transformer assembly for any obvious damage or missing components.
7. Install replacement isolation transformer assembly in chassis. Orient bracket so that the two open screw slots face rear of chassis.
8. Install and secure nuts and washers removed in step 3.
9. Reinstall wires removed in step 3. Double check wiring and secure nuts.
10. Connect AC power plug to AC outlet and test system for proper operation.

Calibration

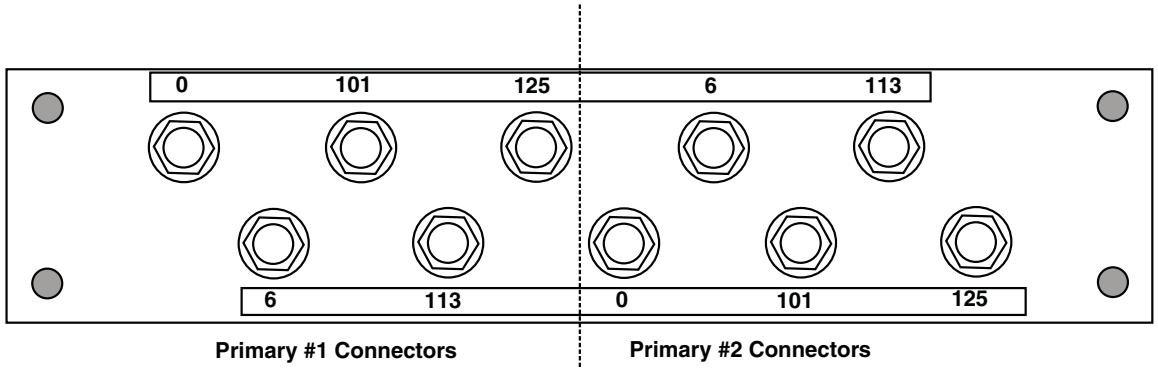
Calibration of the isolation transformer is the process of selecting the taps on each primary winding that most closely match the existing AC line voltage. Calibration may be necessary when the system is moved, when another device is added to or removed from the system's AC branch circuit, when the facility's AC wiring changes, or when there are major changes in the local electrical utility grid. Follow these steps to calibrate the isolation transformer:

***WARNING**: Use care when performing the following line voltage measurement. AC line voltage is dangerous.*

***Note**: Measure the line voltage at the time of day and on a day of the week when the imaging system is most likely to be used. AC line voltages tend to rise during non-peak hours.*

1. Turn off system and disconnect AC plug from facility's AC outlet.
2. Disconnect any other plug which may be connected to facility's AC outlet.
3. Use accurate digital multimeter to measure line voltage at AC outlet. If line voltage measures between 182 and 256 Volts, divide this number by two and record it to the nearest tenth of a volt. If line voltage measures between 91 and 128 Volts, record this value to the nearest tenth of a volt.
4. Remove Workstation covers.

5. Identify the set of AC input terminals for each transformer primary input winding. Note that primary #1's terminals are on the left end of the AC input terminal strip, and primary #2's terminals are on the right end, and both sets of terminals are identical. The input terminal strip appears as follows:



Isolation Transformer AC Input Terminal Strip

6. Follow instructions in table to connect two AC input lines to each primary winding.

Isolation Transformer AC Inputs

If AC line voltage measures	Connect white/blue wire to Primary #1 Terminal	Connect brown wire to Primary #1 Terminal	Connect blue wire to Primary #2 Terminal	Connect white/brown wire to Primary #2 Terminal
92.0 to 97.9	6	101	6	101
98.0 to 103.9	0	101	0	101
104.0 to 109.9	6	113	6	113
110.0 to 115.9	0	113	0	113
116.0 to 121.9	6	125	6	125
122.0 to 128.0	0	125	0	125

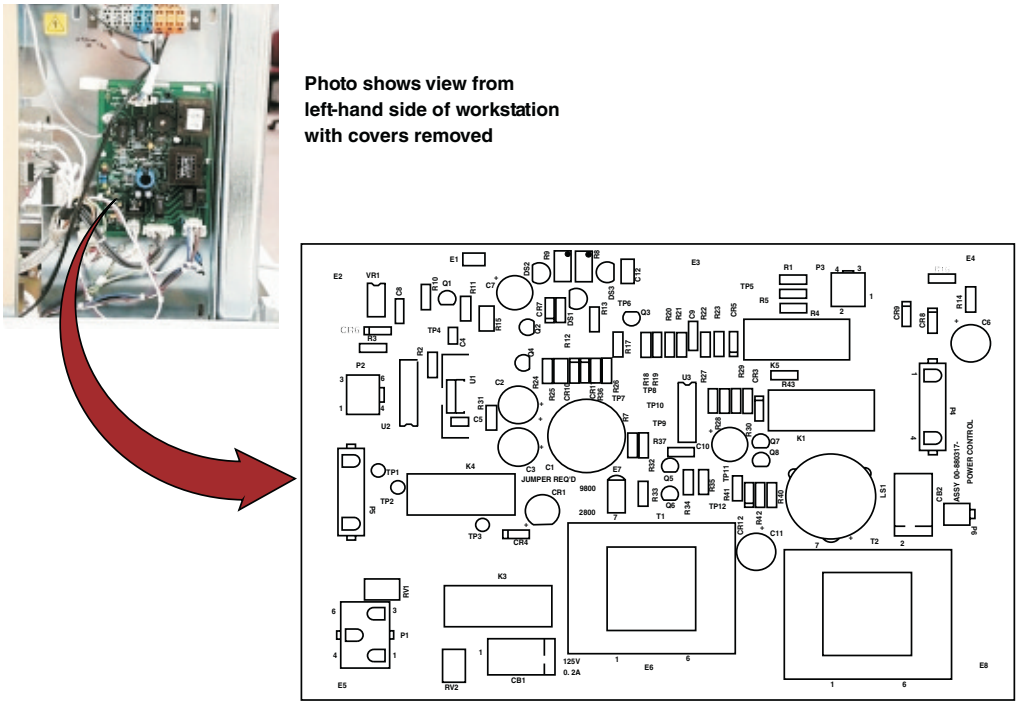
7. Connect AC plug to facility's AC outlet and check system for proper operation.
8. Install Workstation covers.

Power Control PCB

The following paragraphs describe the Power Control PCB. Please refer to **Power Control PCB Schematic 00-880315** while reading this material.

Location

The Power Control PCB is accessible on the lower left-hand side of the Workstation chassis under the left cover.



Power Control PCB

Circuit Description

The following discussion refers to the assembly drawing shown above, to **Workstation Interconnect diagram 00-878981**, and to **Power Control PCB schematic 00-880315**.

Overview

The Power Control PCB uses an Interconnect Cable loop circuit and electromechanical relays to ensure safe distribution of 115 VAC power from CB3 and the distribution of 230 VAC from CB4. The board is also equipped with a window comparator/delay circuit that prevents application of AC power to system circuitry when the line voltage is initially too high or too low, and an audible alarm that sounds when an abnormal line voltage condition prevents normal system power-up.

LOOP and CNCT_ON

The LOOP and CNCT_ON circuits prevent distribution of AC power to external equipment, such as a C-Arm, when the interconnect cable from the Workstation is not properly connected. This helps prevent accidental electric shock from exposed connector terminals.

LOOP. The LOOP circuit consists of a simple wire loop through the interconnect cable which is completed when the interconnect cable is connected.

Relays

The Power Control PCB has four relays, all shown on sheet 1 of the schematic. K1 transfers 230 VAC to Workstation circuitry through P4. K1 also transfers 115 VAC to T2, which generates 10 VAC for the modem. There is no K2. K3 and K4 transfer 115 VAC to external equipment such as a C-Arm, when they are energized. When they are not energized, K3 and K4 ground the AC power pins on the interconnect cable. K5 routes +12 Volts to the Workstation ON/OFF pushbutton (the 12V KEY signal) under normal conditions when it is not energized, or to the audible alarm during AC brown-out or overvoltage conditions.

DC Power Supplies

The DC power supply consisting of T1, full-wave bridge rectifier CR1, and regulator U1 generates +12 Volts, which is present as long as the system power plug is in an active AC outlet. The +12 Volts energizes power distribution relays K1, K3, and K4, and powers VR1, which generates a +10.000-Volt precision reference for the window comparator/delay circuitry shown on schematic sheet 2.

Delay/Window Comparator Circuit

When +12 Volts first appears on the Power Control PCB, C10 (schematic sheet 2) charges to +12 Volts in about 470 ms. This keeps Q3 turned off long enough for the window comparator circuit (composed of the upper two comparators in U3) to stabilize and check the AC voltage from the isolation transformer. (CR9, CR8, and C5 provide a DC equivalent of the AC isolation transformer voltage to the window comparator.) After the 470 ms delay, Q3 turns on, enabling Q1 to turn on also if the window comparator determines it's necessary to interrupt AC power to system circuitry. If the AC from the isolation transformer is too high or too low, Q1 turns on, asserting the *Relay_ON signal, which energizes relay K5 (schematic sheet 1). The window comparator circuit lights red LED DS3 if the AC voltage is too high, the amber LED DS2 if the AC voltage is too low, or green LED DS1 if the AC voltage is within range. When K5 energizes, it disconnects +12 Volts from P3-1, making it impossible to turn the Workstation on with the ON/OFF pushbutton. K5 applies the disconnected +12 Volts to the alarm circuit shown at the bottom center of schematic sheet 1. When K5 energizes, it also grounds U2-14, which deenergizes K3 and K4, preventing any AC power from reaching the external equipment.

Audible Alarm

K5 supplies +12 volts to the alarm when AC power from the isolation transformer is too high or too low. After C11 in the alarm circuit charges (in about 500 ms) the alarm sounds. (The 500 ms delay prevents the alarm from sounding during momentary power outages, and when the system is first plugged in.)

***Note**: Do not attempt to adjust potentiometers R8 or R9. They are factory set.*

***Note**: The Window Comparator/Delay circuit shown on schematic page 2 functions only when you first connect the system to an AC outlet, or after a power interruption that lasts half a second or longer.*

Normal Operation

If the Window Comparator/Delay circuit described above determines AC power from the isolation transformer is within limits, +12 volts exits the Power Control PCB through de-energized K5-2 to P3-1, and travels (as the 12V KEY signal) to the Workstation ON/OFF pushbutton.

When you set the ON/OFF pushbutton to ON, the +12 volts returns to the Power Control PCB on P3-2 (as the KEY_PWR signal). This +12 volts through the ON/OFF pushbutton energizes K1, which supplies 230 VAC to the Workstation.

Relays K3 and K4 supply 115 VAC power to external equipment, but only when they are energized. Note that the positive ends of both relay coils tie directly to +12 volts, so the relays only need a ground to turn them both on. U2 supplies this ground, provided the interconnect cable is in place. A properly installed interconnect cable supplies a ground to U2-1, forcing U2-16 high. This high charges C3 in about 500 ms, which forces U2-15 and U2-3 low. The resulting high on U2-14 propagates through a jumper from E7-1 to E7-2, forcing U2-4 and U2-5 high. U2-12 and U2-13 both go low, driving P2-1 (LOOP2) low. This low travels through the interconnect cable to the external equipment, where it loops back to the Workstation, arriving on P2-3 (LOOP1). The low turns on K3 and K4, supplying 115 VAC power to external equipment. The time delay introduced by U2 ensures there is time to firmly seat the Lemo connector before AC power reaches the external equipment.

***Note**: The jumper at E7 must be installed between pins 1 and 2, or the delay circuit described above WILL NOT work.*

Test Points

***WARNING**: Dangerous voltages are present on some of the following test points.*

The Power Control PCB has a number of useful test points. Normal operating potentials are:

TP1 to **TP2** -- 115 VAC

TP3 to **TP6** -- +12 VDC

TP4 to **TP6** -- +10.000 VDC

TP5 to **TP6** -- +12 VDC

TP8 to **TP6** -- +7.31 VDC

TP10 to **TP6** -- +5.39 VDC

TP11 to **TP6** -- +4 VDC

TP12 to **TP6** -- +1.4 VDC

Circuit Breakers and Fuses

The Power Control PCB has two circuit breakers and no fuses.

CB1 is a .2-Amp reset only circuit breaker that protects the +12 VDC power supply.

CB2 is a .2-Amp reset only circuit breaker that protects T2, which supplies 10 VAC to the modem.

Troubleshooting

- If CB1 opens, U1 fails, or VR1 fails, the entire system will fail to operate. The only activity indicator will be a green AC pilot light glowing on the Workstation rear panel.
- If CB2 is open or T2 fails, the modem won't work.
- If K1 fails open, 230 VAC power will not be applied to Workstation components. If K1 fails closed, the system will continue to operate, but the Workstation ON/OFF pushbutton will not turn off AC power.
- If K3 or K4 fail open, no AC power will reach the external equipment. If K3 and K4 both fail closed, the safety interlock circuitry won't work. This is a very unlikely scenario.
- If K5 fails open, the system will continue to operate, but it will be unprotected from overvoltage or undervoltage problems. If K5 fails closed, the audible alarm will sound and neither the Workstation nor the external equipment will receive AC power.
- If U3 fails, the window comparator and associated delay circuit won't work. Depending on the nature of the U3 failure, K5 may or may not be energized.
- If you find a failed component on the Power Control PCB, replace the board.

Removal and Replacement

1. Disconnect AC power plug from facility's AC outlet.
2. Remove lower left-hand Workstation cover.
3. Remove six screws that attach Power Control PCB to chassis. Retain six screws associated hardware for reuse.
4. Disconnect and tag connectors from P1 through P5.
5. Inspect replacement Power Control PCB for any obvious damage or missing components.
6. Re-connect P1 though P5 to replacement board.
7. Mount replacement PCB to chassis and secure mounting hardware.
8. Connect AC power plug to AC outlet.
9. Check system for proper operation.
10. Install Workstation cover removed in step 2.

Calibration

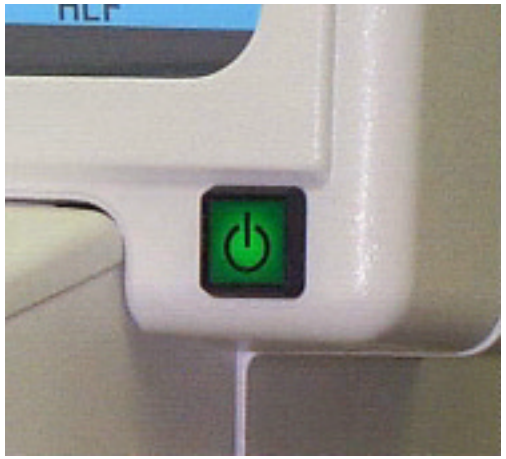
No adjustments are necessary after replacing the Power Control PCB.

Lighted ON/OFF Pushbutton

This paragraph describes the Workstation's lighted ON/OFF pushbutton that controls the application of AC power to Workstation circuitry. The pushbutton has an incandescent bulb that lights when AC power is applied. A nut behind the monitor bezel secures the pushbutton to the Workstation.

Location

The lighted ON/OFF pushbutton is located just below and to the right of the right-hand monitor (secondary display).



Lighted ON/OFF Pushbutton

Removal and Replacement

Follow these steps to replace the Workstation's ON/OFF pushbutton:

1. Disconnect AC power plug from facility's AC outlet.
2. Remove Monitor cover.
3. Carefully pull switch cable's faston connectors from pushbutton terminals.
4. Loosen threaded collar that holds pushbutton to monitor bezel.
5. Pull pushbutton through front of Workstation chassis.
6. Inspect replacement pushbutton for obvious damage or missing components.
7. Use ohmmeter to identify switch and bulb terminals on replacement pushbutton assembly.
8. Position pushbutton's flexible gasket so hole in gasket fits over index pin on pushbutton.
9. Place new pushbutton assembly in Workstation chassis mounting hole.
10. Install threaded collar on pushbutton and secure pushbutton to Workstation chassis as shown in above illustration.
11. Connect orange and red wires in switch cable to switch terminals on pushbutton assembly.
12. Connect black and green wires in switch cable to bulb terminals on pushbutton assembly.
13. Connect AC power plug to facility's AC outlet.
14. Test replacement pushbutton for proper operation.
15. Install Monitor cover.

Terminal Blocks

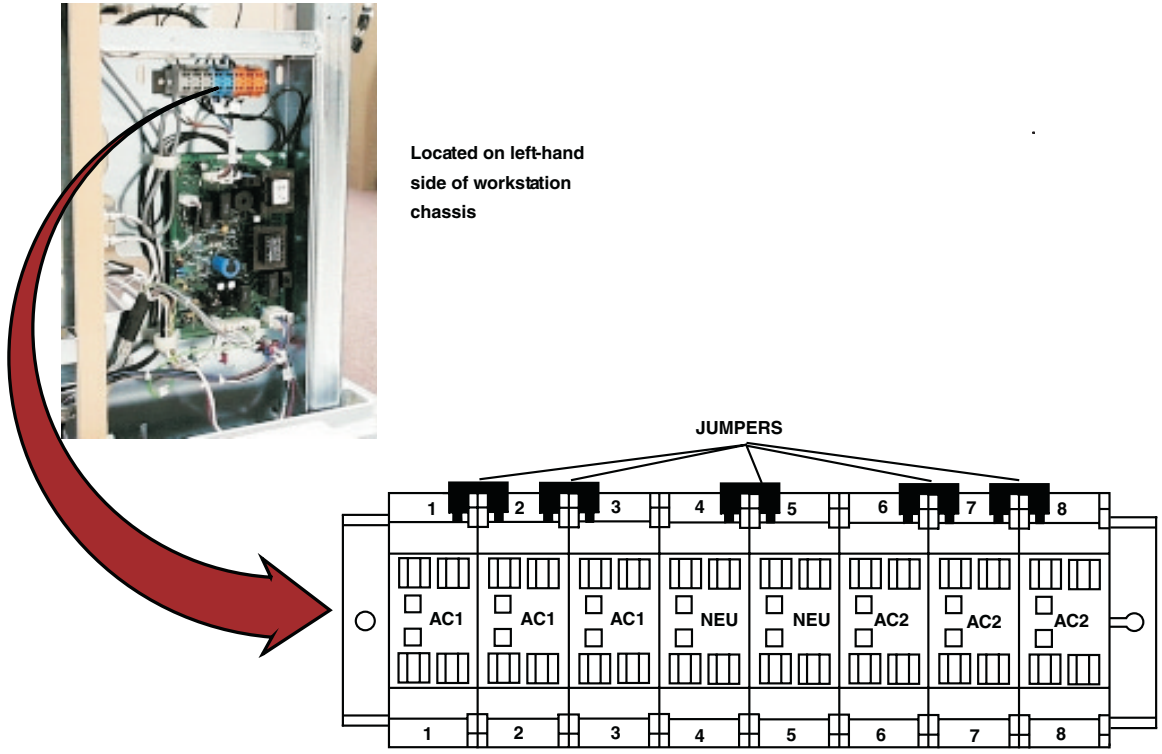
There are five terminal blocks that distribute AC power from the Power control PCB to Workstation circuitry. The terminal blocks appear on sheets 1, 3, and 4 of the **Workstation Interconnect Diagram 00-878981**.

TB1

TB1, which is part of the **AC Power Cord Assembly mounting plate** located in the lower left-hand corner of the Workstation rear panel, is the entry point for AC line voltage into the system.

TB2

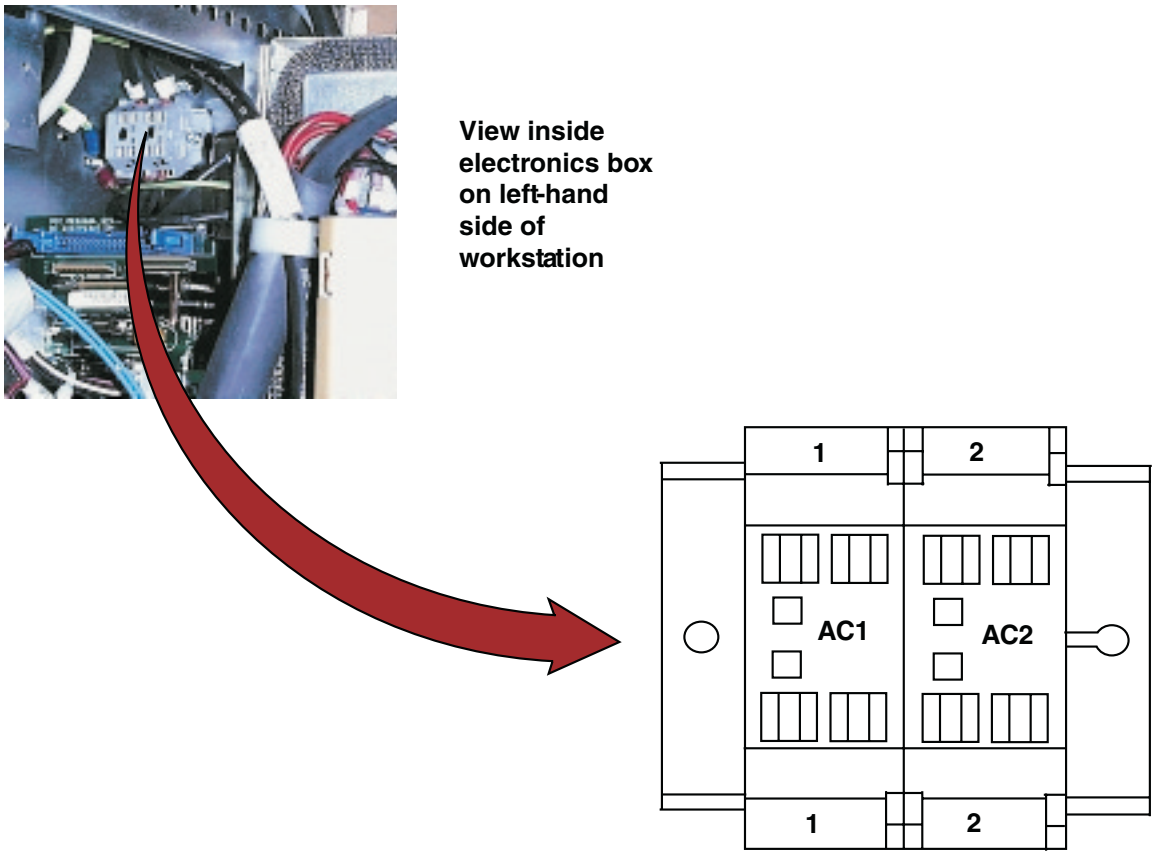
TB2 is located just above the Power Control PCB on the lower left-hand side of the Workstation chassis. TB2 accepts 230 VAC with ground from the Power Control PCB. TB2 distributes 115 VAC power to cooling fans B2 and B3. It also distributes 230 VAC power through LF1 to TB3, and 230 VAC with neutral to TB4.



TB2

TB3

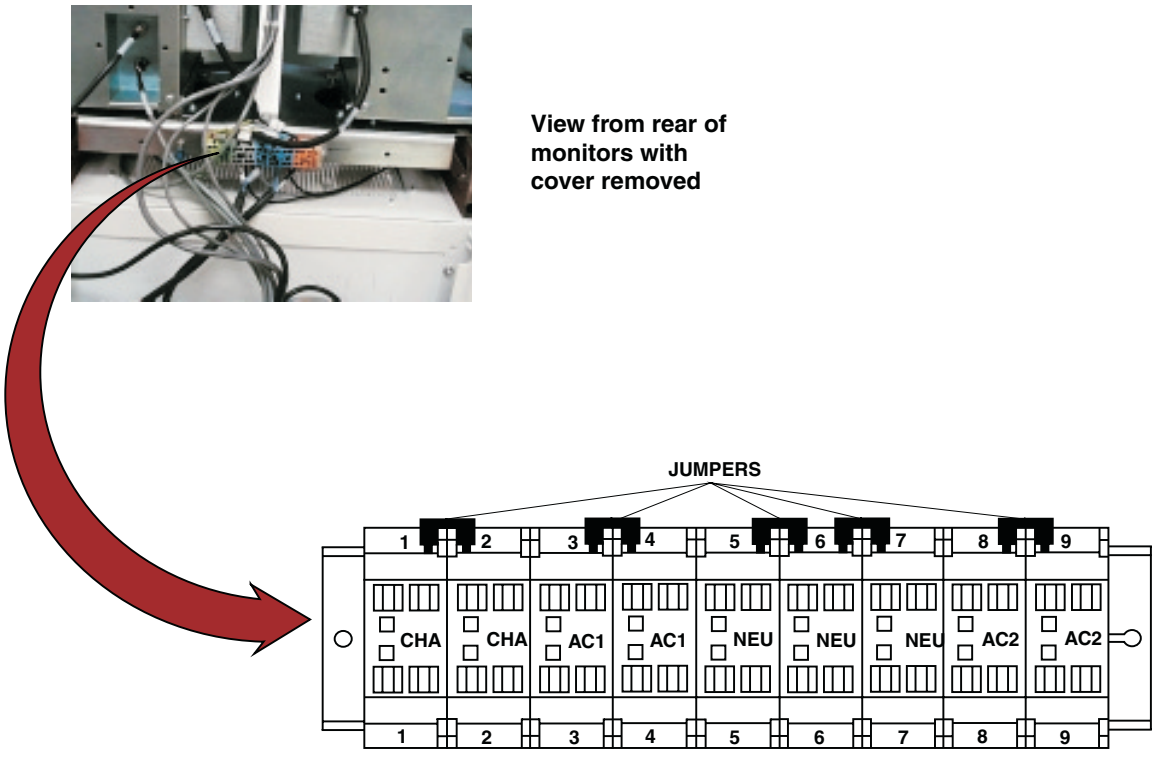
TB3 is located inside the Workstation Electronics Box on the rear wall near the top. TB3 distributes 230 VAC to the optional Cine 4-Disk Backplane assembly and to DC Power Supply PS1.



TB3

TB4

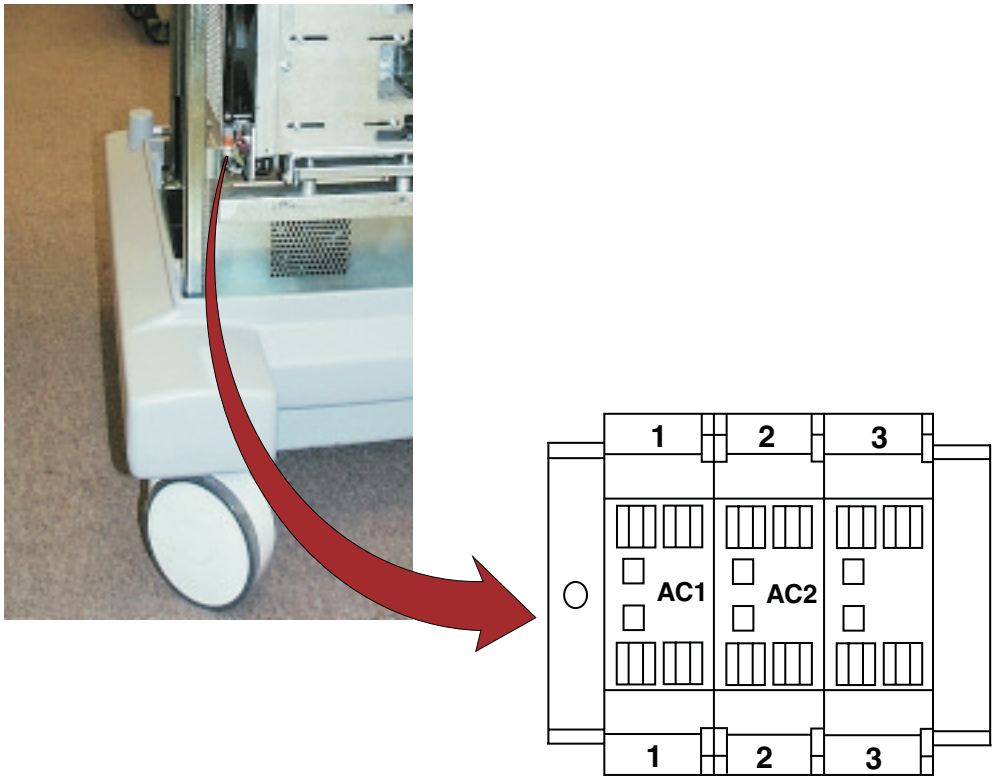
TB4 is the large terminal block just below the two monitor assemblies on the rear of the Workstation chassis. TB4 accepts 230 VAC with neutral from TB2. TB4 distributes 115 VAC to the two high resolution monitors, 115 VAC to the Elapsed Time Indicator, and 115 VAC to fans B4 and B5.



TB4

TB5

TB5, located inside the optional Cine 4-Disk assembly, accepts 230 VAC from TB3 and distributes this power to cooling fans and to DC power supply PS2.



TB5

DC Power Distribution

Workstation Interconnect Diagram 00-878981 shows the Workstation's DC power distribution circuitry. In addition to PS1 (sheet 4) and PS2 (sheet 1), several Workstation PCBs have DC power supply circuits that generate the potentials necessary to operate their internal circuitry. Refer to individual PCB circuit descriptions elsewhere in this manual for information on these power supplies.

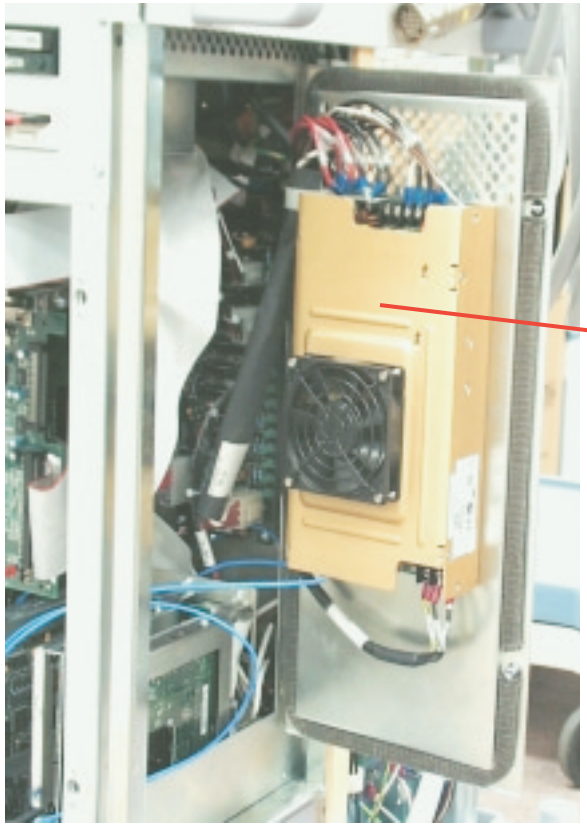
DC Power Supply PS1

PS1 generates +5 VDC at 35 Amps, +12 VDC at 10 Amps, 5 to 25 VDC at 6 Amps (not used), and -12 VDC at 6 Amps. The DC Power Distribution PCB routes these potentials to Workstation circuitry.

Location

PS1 mounts on the lower left-hand side of the Workstation chassis behind a swing-out panel. Remove the Workstation cover and loosen the two quarter-turn fasteners that secure the

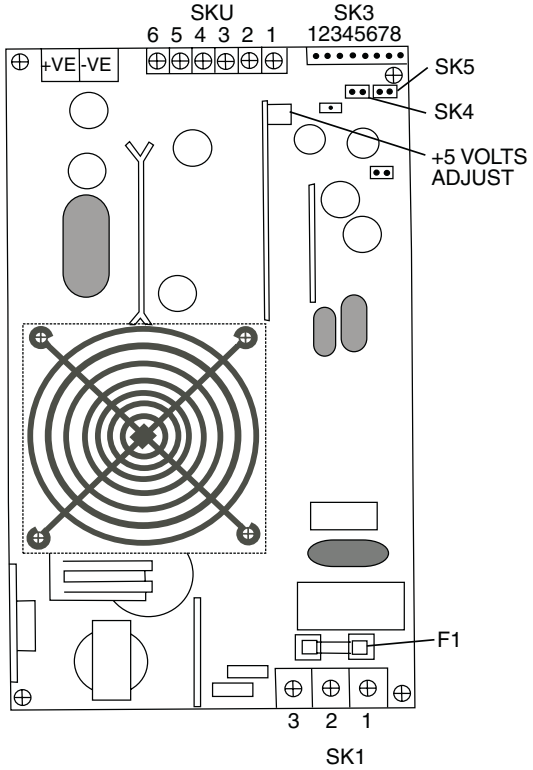
swing-out panel to gain access to the supply.



DC Power Supply PS1

Circuit Description

This discussion refers to the following assembly drawing, which shows PS1 with its cover removed. A schematic diagram for the power supply is not available.



PINS USED

SK1	PIN 1	NEUTRAL
	PIN 2	LINE
	PIN 3	GROUND
SK2	PIN 1	+12 VOLTS
	PIN 2	COMMON
	PIN 3	COMMON
	PIN 4	+12 VOLTS
SK3	PIN 7	POWER FAIL (TTL LOW)
SK4	PIN 1	+12 VOLTS @ 500 MA (FAN)
	PIN 2	GROUND

F1 IS 4A @ 250V FAST BLOW

PS1 Controls and Connectors

AC Input (SK1)

The System DC Power Supply (PS1) is a multi-output, switch mode supply powered by 230 VAC from the Isolation Transformer. AC Power travels from the Isolation Transformer through CB4 to P1 on the Power Control PCB. AC Power exits the Power Control PCB on P4, and travels through TB2, LF1, and TB3 to SK1 on PS1.

Overload Protection

PS1 is fully protected against short circuit and output overload. Recovery after a short circuit or overload fault is automatic.

Overvoltage Protection

Occurs when +5V output is between +5.7 to +6.7 VDC. Protection occurs on other outputs when they are 10% to 25% above nominal levels.

Thermal Overload Protection

The power supply shuts down all outputs when the chassis temperature becomes excessive. Recovery is automatic after the chassis cools.

Power Fail Indicator

PS1 outputs a TTL low on SK3-7 when it senses an AC power brownout condition. This happens at least 4 ms before loss of regulation. The **DC Power Distribution PCB** accepts the Power Fail signal on J4-13 and routes it through J5-15 to J5 on the **System Interface PCB** for further processing.

Voltage Adjustment

Only the 35-Amp +5 Volt output on PS1 is manually adjustable. The adjustment range is 4.75 to 5.25 Volts.

+VE/-VE

These two terminals provide 5 Volts DC at 35 Amps.

SK2

This connector provides the +12 Volts at 10 Amps, and -12 Volts at 6 Amps.

SK3-7

This connector provides the Power Fail TTL signal to the System Interface PCB

SK4 and SK7

These two connectors each provide 12 Volts at 500mA. The DC fan on PS1's cover normally connects to SK4.

Test Points

***WARNING**: Dangerous AC line voltage is present on SK1.*

There are no designated test points on PS1. Make input AC voltage measurements on connector SK1, and DC voltage measurements on +VE/-VE, SK2, SK3, SK4, and SK7.

Circuit Breakers and Fuses

F1 is a 4 Amp fast blow 250 VAC fuse that protects PS1's internal circuitry. This fuse does not blow if PS1's outputs are shorted or overloaded.

Troubleshooting

A short or overload on PS1's outputs causes them to drop. Look for obvious problems like shorted filter capacitors on other PCBs before replacing the supply. If PS1's outputs are simply out of spec and don't respond to the calibration procedures described below, replace the supply.

Removal and Replacement

Follow these steps to replace PS1:

***WARNING**: Dangerous AC line voltage is present on SK1.*

1. Disconnect AC power plug from facility's AC outlet.
2. Remove lower left-hand Workstation cover.
3. Loosen two quarter-turn fasteners that secure swing-out panel to lower left-hand side of chassis. Swing panel away from chassis.
4. Disconnect and tag wires from +VE, -VE, SK1, SK2, and SK3 terminals.
5. Remove four torx screws and lockwashers that secure PS1 assembly to chassis swing-out panel. Retain four screws and four lockwashers for reuse.
6. Inspect replacement power supply assembly for any obvious damage or missing components.
7. Mount replacement power supply assembly to chassis swing-out panel and secure mounting hardware.
8. Connect wires removed in step 4 to +VE, -VE, SK1, SK2, and SK3 terminals on replacement power supply. Secure all screws.
9. Connect AC power plug to facility's AC outlet.
10. Perform calibration procedure described below.
11. Check system for proper operation.
12. Close swing-out panel and secure quarter-turn fasteners.
13. Reinstall lower left Workstation cover.

Calibration

Calibration of the DC Power Supply PS1 consists of checking each output for proper voltage under load and making adjustments to the high-current +5 Volt output if necessary.

WARNING: *Dangerous AC voltages are present on connector SK1 of DC Power Supply PS1 during the following calibration procedure.*

CAUTION: *Be careful when making the following measurements. Short circuiting a DC output can cause burns and equipment damage.*

Note: *Make sure PS1 is fully installed with all loads connected before performing the following calibration procedure.*

Calibrate DC Power Supply PS1 as follows:

1. Remove left side Workstation cover.
2. Loosen two quarter-turn fasteners that secure swing-out panel to lower left-hand side of chassis. Swing panel away from chassis.
3. Make sure system's AC power plug is connected to facility's AC outlet.
4. Press Workstation ON/OFF pushbutton to turn on Workstation. Make sure pushbutton lights.
5. Check output of high current +5 Volt supply on +VE and -VE terminals. Output should measure +5.0 (±.25) VDC. If +5 Volt output is within range, go to step 7. If +5 Volt output needs adjustment, go to next step.

6. Adjust 5V O/P ADJ pot until output measures +5.0 (±.1) VDC. If PS1 cannot be adjusted to produce a satisfactory output under normal load conditions, replace PS1.
7. Check output of +12 Volt supply on SK2. Output should measure +12 (±1) VDC. This supply is not adjustable.
8. Check output of -12 Volt supply on SK2. Output should measure -12 (±1) VDC. This supply is also not adjustable.
9. Install left side Workstation cover.

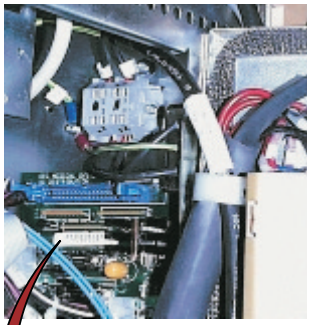
***Note**: If one or more DC outputs from PS1 do not meet specifications, replace PS1. If PS1 calibration is successful, disconnect the meter leads and perform the last three steps in the above Removal/Replacement procedure.*

DC Power Distribution PCB

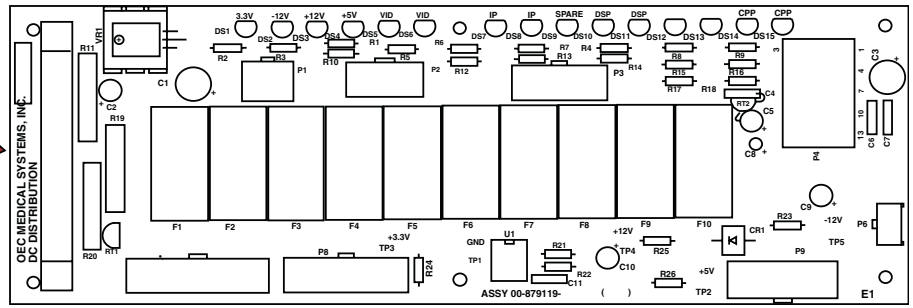
The DC Distribution PCB distributes DC power from PS1 to Workstation circuitry. The DC Distribution PCB is located inside the Workstation's Electronics Box near PS1.

Location

Remove the Workstation covers, loosen the two quarter-turn fasteners that secure PS1's swing-out mounting bracket, and swing out the bracket to gain access to the DC Distribution PCB.



View inside electronics box on left-hand side of workstation



DC Distribution PCB

Circuit Description

Refer to the following assembly drawing and to **DC Distribution PCB Schematic 00-879117** while reading the following description.

Overview

The DC Distribution PCB distributes DC potentials and the PWR_FAIL signal from PS1 to Workstation circuitry. The DC Distribution PCB also distributes voltage sense and and temperature signals from Workstation circuitry to the External Interface PCB.

Host CPU Reset

U1 supplies a reset signal to the Host CPU through P9 if the +5 Volt supply from PS1 drops below +4.65 Volts.

+3.3 Volt Supply

VR1 on the DC Distribution PCB generates a +3.3 Volt supply from +5 Volts, which P7 distributes to the Image Processor PCB and Video Controller PCB, and which P8 distributes to the Display Controller PCB and Cine Bridge PCB.

Status LEDs

There are 15 status LEDs on the DC Distribution PCB.

DS1 lights when VR1 is active and +3.3 Volts is present.

DS2 lights when -12 Volts from PS1 is present.

DS3 lights when +12 Volts from PS1 is present.

DS4 lights when +5 Volts from PS1 is present.

DS5 lights when the +5V_SEN signal from the Video Controller PCB is present.

DS6 lights when the +3.3V_SEN signal from the Video Controller PCB is present.

DS7 lights when the +5V_SEN signal from the Image Processor PCB is present.

DS8 lights when the +3.3V_SEN signal from the Image Processor PCB is present.

DS9 is not used.

DS10 lights when the +5V_SEN signal from the Display Controller PCB is present.

DS11 lights when the +3.3V_SEN signal from the Display Controller PCB is present.

DS12 lights when the +3.3V_SEN signal from the Cine Bridge PCB is present.

DS13 lights when the +5V_SEN signal from the Cine Bridge PCB is present

DS14 lights when the +5V_SEN signal from the Control Panel Processor PCB is present.

DS15 lights when the +12V_SEN signal from the Control Panel Processor is present.

Distribution Functions

The DC Distribution PCB's nine connectors distribute DC power, control signals, and status signals as follows:

P1 supplies +5 Volts and +12 Volts from PS1 to the Control Panel Processor. P1 also accepts +5 Volt and +12 Volt sense signals from the Control Panel Processor for distribution through P5 to the System Interface PCB.

P2 supplies +5 Volts and +12 Volts from PS1 to the Floppy Disk Drive.

P3 supplies +5 Volts and +12 Volts from PS1 to the Cine 2 Disk Backplane and to the Hard Disk Drive.

P4 distributes +5 Volts, +12 Volts, and -12 Volts from PS1 to Workstation circuitry. It also transfers the PWR_FAIL signal from PS1 through P5 to the System Interface PCB. The +3.3 Volt input to PS1 on P4-9 is not used.

P5 provides +5 Volts and +12 Volts from PS1 to the System Interface PCB. P5 also supplies the System Interface PCB with the PWR_FAIL signal from PS1, and with temperature and voltage sense signals from other Workstation circuitry.

P6 accepts +12 Volt sense, +5 Volt sense, and temperature signals from the Cine 4-Disk Backplane and distributes these signals through P5 to the System Interface PCB.

P7 supplies +5 Volts and +3.3 Volts to the Video Controller and Image Processor. PS1 generates the +5 Volts, and VR1 generates the +3.3 Volts. P7 also accepts +3.3 Volt and +5 Volt sense signals, transferring them through P5 to the System Interface PCB.

P8 supplies +5 Volts and +3.3 Volts to the Display Controller and Cine Bridge assembly. P8 also accepts +3.3 Volt and +5 Volt sense signals, transferring them through P5 to the System Interface PCB.

P9 supplies +5 Volts, +12 Volts and -12 Volts to the Host CPU, and +12 Volts to the Host CPU's DC fan. U1 on the DC Distribution PCB sends the reset signal *SYSRST through P9-8 to the Host CPU when the +5 Volt supply falls below +4.65 Volts.

Test Points

There are five test points on the DC Distribution PCB.

TP1 is chassis ground.

TP2 is +5 Volts.

TP3 is +3.3 Volts.

TP4 is +12 Volts.

TP5 is -12Volts.

Circuit Breakers and Fuses

There are ten fuses on the DC Distribution PCB.

F1 is a 6.3 Amp, 250 Volt fuse that protects +5 Volts to the System Interface PCB and Cine Bridge assembly.

F2 is a 10 Amp, 250 Volt fuse that protects +5 Volts to the Video Controller and Image Processor.

F3 is a 1 Amp, 250 Volt fuse that protects +12 Volts to the Control Panel Processor, the Cine 4 Disk Backplane, and System Interface PCB.

F4 is a 5 Amp, 250 Volt fuse that protects +12 Volts to the Floppy Disk Drive and Magneto Optical Drive.

F5 is a 5 Amp, 250 Volt fuse that protects +5 Volts to the Floppy Disk Drive and Magneto Optical Drive.

F6 is a 3.15 Amp, 250 Volt fuse that protects +5 Volts to the Control Panel Processor.

F7 is a 5 Amp, 250 Volt fuse that protects +12 Volts to the Hard Disk Drive and Cine 2 Disk Backplane.

F8 is a 5 Amp, 250 Volt fuse that protects +5 Volts to the Hard Disk Drive and Cine 2 Disk Backplane.

F9 is a 10 Amp, 250 Volt fuse that protects +5 Volts to the Host CPU.

F10 is a 5 Amp, 250 Volt fuse that protects +12 Volts to the Host CPU and Host CPU fan.

Troubleshooting

Since most of the DC Distribution PCB circuitry is passive, the most likely failure is a fuse. If U1 fails, the Host CPU may spontaneously reboot or lock up. If VR1 fails, the Video Controller, Image Processor, Display Controller, or Cine Bridge PCBs may also fail.

Removal and Replacement

1. Disconnect AC power plug from facility's AC outlet.
2. Remove Workstation covers.
3. Loosen two quarter-turn fasteners that secure swing-out PS1 bracket to lower left-hand side of Workstation chassis.
4. Swing out PS1 bracket to gain access to DC Distribution PCB.
5. Remove six torx screws and lockwashers that secure DC Distribution PCB to Electronics Box. Retain six screws and four lockwashers for reuse.
6. Disconnect and tag connectors from P1 through P9.
7. Inspect replacement DC Distribution PCB for any obvious damage or missing components.
8. Reinstall connectors on P1 through P9 on replacement DC Distribution PCB.
9. Mount replacement DC Distribution PCB in Electronics Box using hardware removed in step 5. Secure hardware.
10. Connect AC power plug to facility's AC outlet.
11. Check system for proper operation.
12. Close swing-out power supply bracket loosened in step 3 and secure quarter-turn fasteners.
13. Reinstall Workstation covers.

Calibration

No adjustments are necessary after replacing the DC Distribution PCB.

Cine Disk Power Supply PS2

PS2 is part of the optional Cine 4-Disk Assembly, and supplies +5 VDC and +12 VDC to the Cine 4-Disk Backplane. It is identical to PS1, except that PS2's -12 Volt output is not used.

Please refer to **DC POWER SUPPLY PS1** for technical information that is applicable to PS2.